NOVEMBER/DECEMBER 2024

23PPH21 — STATISTICAL MECHANICS

Time : Three hours Maximum : 75 marks

Thiruvalluvar Arts & Science College T.V.Malai

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Define phase transition and provide an example.
2. Short note on Gibb's phase rule.
3. What is the difference between microstates and macrostates?
4. Relate the entropy in the context of statistical mechanics.
5. What is a partition function?
6. Summarize the canonical ensemble.
7. What is the Maxwell-Boltzmann distribution?
8. Classify the Fermi-Dirac statistics.
9. Show the Ising model.
10. Define Brownian motion.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Compare the significance of Landau's theory of phase transition.

Or

(b) Distinguish the process of scale transformation in phase transitions.

12. (a) Inference the connection between statistics and thermodynamics.

Or

(b) List the entropy of an ideal gas using the microcanonical ensemble.

13. (a) Give the significance of density fluctuations in statistical mechanics.

Or

(b) Describe the application of the partition function in thermodynamics.

14. (a) Discuss the concept of Bose-Einstein condensation.

Or

(b) Differentiate classical and quantum statistics.

15. (a) Explain the fluctuation-dissipation theorem.

Or

(b) Discuss the mean-field theory of the Ising model.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Criticize the role of order parameters in Landau's theory of phase transition.

17. Explain how the microcanonical ensemble is used in statistical mechanics.

18. Listout the application of the grand canonical ensemble in real-world systems.

19. Discuss the implications of Bose-Einstein statistics on the behavior of an ideal Bose gas.

20. Elaborate the application of the Fokker-Planck equation in describing transport phenomena.

Sri Ramakrishna Industries Arts & Science College T.V.Malai